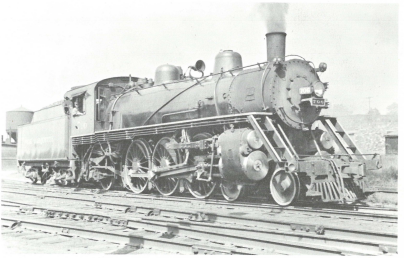
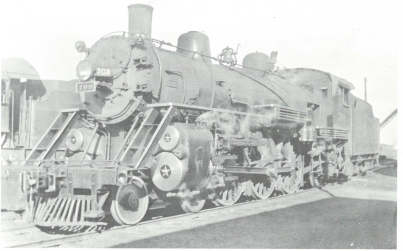
NOVEMBER
1969
45¢

Live Steam

THE MONTHLY MAGAZINE FOR ALL LIVE STEAMERS AND LARGE-SCALE MODEL RAILROADERS





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The Pere Marquette's Class SP Pacifics

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Live Steam
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COVER PHOTOS

Engine 706, first of the Pere Marquette's 5P Class Pacifics, sporting a 10,000 gallon-16 ton capacity tender on August 1st, 1939 (top) and the 708 (lower) photographed on November 26th, 1957 in Muskegon, Michigan by Henry J. Walhout.

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The Pere Marquette's Pacifics

Prepared from data supplied by Philip F. Geary, Jr.
Richard D. Orlik
Philip A. Shuster
Alvin F. Staufer
Henry J. Walhout

When the Pere Marquette's first Pacifics were delivered in June of 1910, they were put to work immediately and we can well imagine that the Master Mechanic and his staff were aboard these engines on most of their assignments. By watching their performance and noting their deficiencies they were ready to order a second group of five engines within a few months and the American Locomotive Company received the order.

When the new engines were completed at Schenectady in June of 1911 they were, from all outward appearances, duplicates of the first five. About the only difference in construction specifications was an increase of 2" in the stroke of the cylinders, but the resulting changes were significant. The longer stroke on the new 5P Class required a larger cylinder casting which added 2,000# to the overall weight of the engines as compared with the P–2 Class. Of this added weight, 1,300# was carried on the lead truck and only 500# fell on the drivers and this proportioning resulted in a factor of adhesion of 4.66 as compared to the 5.00 rating of the P–2's. The longer stroke also figured in an increase of 2,100# in the Tractive Power of the new engines which were numbered 706 through 710 and carried Alco's construction numbers 50044 through 50048.

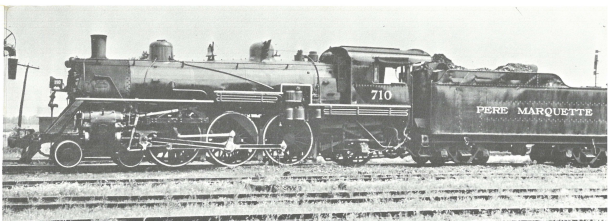
The PM Pacifics were small by almost any standard. Small in stature, in power and in weight if you compared them with any of their contemporaries – and especially with the Alco Experimental Pacific #50000 which later became Erie #2509. But they were satisfactory for the Pere Marquette needs and served faithfully for many years. The "face-lifting" so common on many railroads that often resulted in extreme esthetic variations within a class of engines, never occurred on the Pere Marquette. With the exception of changes of tenders occasionally, the engines never exhibited any appreciable change in appearance.

In December 1946 the 708 was retired from the roster and on April 4th, 1947 it was sold to the Purdy Company, scrap dealers in Chicago. The 710 followed into retirement in May, 1947 and was dismantled by the PM in Saginaw, Michigan on September 30th of that year. The 709 was next to go; retired in August, 1947 and sold to Summer & Company of Buffalo, N. Y. on October 20th of that same year. In October, 1947 the 706 was removed from service and sold to the Gary Steel Supply Company in Chicago on December 17th, 1947. The last of the 5P Class, Engine 707, was taken off the PM roster in November, 1947 and on January 7th, 1948 it too was sold to the Gary Steel Supply Company.

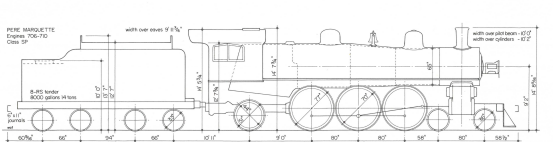
The Pere Marquette's third group of Pacifics brought quite a change into the line of equipment. More about that in the December issue of LIVE STEAM Magazine.

COMPARATIVE SPECIFICATIONS OF SCHENECTADY-BUILT PACIFICS

Road	PM	PM	NYC	NYC	C&NW	C&NW	Alco
Class	P-2	5P	Kh	K2i	E	E	Exper.
Numbers	701-705	706-710	6425	3470	1500-1539	1540-1544	50000
Date	1910	1911	1910	1910	1910	1910	1910
Cylinders	22 x 26	22 x 28	22 x 26	22 x 28	23 x 28	25 x 28	27 x 28
Driver Dia.	77"	77"	75"	79"	75"	75"	79"
Boiler Dia.	65"	65"	70-5/8"	70-5/8"	70½"	70½"	76-3/8"
Pressure	200#	200#	200#	200#	190#	190#	185#
Firebox	90⅝x70⅝	90⅝x70⅝	96¼x75⅛	108x75	108x70⅝	108x70⅝	114x75⅛
Engine Weight	216,000#	218,000#	235,000#	262,000#	245,000#	250,500#	269,000#
Tractive Power	27,800#	29,900#	28,520#	29,160#	31,900#	37,800#	40,650#



C & O RAILROAD – ALVIN F. STAUFER COLLECTION



PROTOTYPE SPECIFICATIONS

Cylinders	22" x 28"
Valves	12" Piston Valves, 6" travel, 1-1/16" lap, ¼" lead, 3/16" exhaust clearance
Valve Gear	Walschaerts
Boiler	
Pressure	– 200# p.s.i.
Tubes	– 183 2" o.d.
Flues	– 24 5-3/8" o.d.
Length	– 209'-7"
Arch Tubes	– 3 3" o.d.
Superheater Tubes	– 1½" o.d.
Firebox	Length – 90½"
	Width – 70½"
	Grate Area 46.1 sq. ft.
Heating Surfaces Tubes & Flues	2578 sq. ft.
Firebox	169 sq. ft.
Arch Tubes	16 sq. ft.
Total	2761 sq. ft.
Superheater	557 sq. ft.
Total	3318 sq. ft.
Weight in Working Order	
Engine Truck	41,500#
Drivers	139,500#
Trailing Truck	37,000#
Engine Total	218,000#
Tender	158,000#
Engine & Tender	376,000#
Tractive Effort	29,900#
Journals	Driving, Main 10" x 12"
	Driving, Others 9½" x 12"
	Engine Truck 6" x 10"
	Trailing Truck 8" x 14"
Crank Pins	Main – 7" & 7⅞" x 7½"
Factor of Adhesion – 4.66	
Cylinder Horse Power – 1742	
Percent Boiler to Cylinder H.P. – 91.1	
Tender Frame – Channels	
Tender Truck Frame – Arch Bar	
Superheater Type A	
Safety Valves 2 – 3½"	
Maximum Curve – 20°	

LIVE STEAM CONVERSIONS

Prototype	Scale		
	¾" = 1'0"	1" = 1'0"	1½" = 1'0"
22"	1.375"	1.833"	2.750"
28"	1.750"	2.332"	3.500"
33"	2.063"	2.749"	4.125"
36"	2.250"	3.000"	4.500"
44"	2.750"	3.665"	5.500"
51"	3.188"	4.248"	6.375"
58"	3.625"	4.831"	7.250"
58½"	3.656"	4.873"	7.313"
60-9/16"	3.785"	5.045"	7.570"
65"	4.063"	5.415"	8.125"
66"	4.125"	5.498"	8.250"
70"	4.375"	5.831"	8.750"
77"	4.813"	6.414"	9.625"
80"	5.000"	6.664"	10.000"
94"	5.875"	7.830"	11.750"
9'- 0"	6.750"	9.000"	13.500"
9'- 2"	6.875"	9.163"	13.750"
9'-11¾"	7.484"	9.975"	14.967"
10'- 0"	7.500"	10.000"	15.000"
10'- 2"	7.625"	10.163"	15.250"
10'-11"	8.188"	10.912"	16.375"
12'- 2"	9.438"	12.578"	18.875"
12'- 7⅝"	9.483"	12.641"	18.967"
13'- 2"	10.188"	13.578"	20.375"
14'- 5¾"	10.859"	14.473"	21.719"
14'- 7¾"	10.984"	14.640"	21.969"
14'- 8.11/16"	11.043"	14.718"	22.086"
18'-10"	14.125"	18.826"	28.250"
33'-10"	25.375"	33.820"	50.750"
63'- 7"	47.688"	63.558"	95.375"
73'- 6.1/16"	55.129"	73.476"	110.258"
37,000#	13.246#	30.821#	99.530#
41,500#	14.857#	34.570#	111.635#
139,500#	49.941#	116.204#	375.255#
158,000#	56.564#	131.614#	425.020#
218,000#	78.046#	181.594#	586.420#
376,000#	134.608#	313.208#	1011.440#

BRAKES, BOILERS AND

A Guest Editorial by Paul B. Boivin, Jr.
Editor
New Jersey Live Steamers' "WHISTLE BLAST"

There has been much talk lately about model boilers and their regulation.[1] Once in a while, brakes and flanges find their way in publications and informal conversations, but boilers get all the press. These three areas seem to be the only vulnerable points with Live Steamers – vulnerable because there is some fear of mandatory regulation. The prospect of having someone or some group telling you what you must do to pursue your hobby in some way takes all of the enjoyment away. After all, isn't the reason people take up hobbies is to have some relaxed fun, free of the regimentation of "regulation by the elders?" Everything we seem to do is hampered by some kind of rule – "do it this way, or else..." Why can't we be able to do some one thing the way we want, and only the way we want, regardless of what the next guy thinks?

There are many hobbies that one can get into for the mere fun of it. Surprisingly, many of them are regulated in some way, either by standards within the hobby[2] or by some local, state or federal law. The degree of regulation seems to depend largely on bodily injury or nuisance to others. For instance, there are no regulations on stamp collecting or model railroading in your basement because the likelihood of anyone getting hurt or annoying anyone in the pursuit of these hobbies is very remote. Amateur radio is regulated by Federal Law and has very strict rules that must be followed under penalties, regardless of what any one individual thinks. This detracts from his enjoyment of the hobby, since the pursuit of this particular hobby can be a nuisance to others. And hunting with a rifle is now very well regulated, both by hunting licenses and gun control laws, because of the threat of injury from this hobby. (We've all heard the loud squawking from this group.) So it should not be surprising that Live Steam model railroading is regulated in some areas regardless of its status as a hobby, because people are afraid of boiler explosions, getting severely scalded by steam, or being injured by collisions caused by absence of brakes, or derailments caused by square flanges. This is the reasoning, we suppose, behind the boiler laws in some states, the boiler testing rules along with brake and flange regulations of most Live Steam clubs.

In the matter of boiler laws, most fellows prefer to let a sleeping dog lie; that is, "Don't make waves!" All model boilers are over-designed anyhow, and the likelihood of a boiler explosion is very small. In fact, a while back, the British had a lot of trouble actually trying to explode a model boiler in a home-made chamber made of an old oak table.[3] Yet, the first instance of injury from a model boiler within the United States that received widespread press coverage could bring about the wrath of the public and all sorts of state bureaucrats on everyone who owns and operates anything that makes steam – from pressure cooker, to wallpaper remover, to household heating, to model locomotive. Is it not wiser to do something for ourselves *before* any unfortunate event happens? If laws must be had covering model boilers, shouldn't *we* of the Live Steam fraternity write those laws instead of letting them be written by some legislator or P.E. who has no understanding of our hobby? And if we "swear by our boilers," none of which carry ASME certifications, shouldn't we be at least willing to test them out annually at double working pressure hydrostatic to convince others if not ourselves that they *are* okay? Sure, this is a big nuisance, and may take some fun out of the hobby, but let one disaster happen where the press gets hold of it, and then no one can have fun with Live Steam anymore. Yes, it may be a so-called "free country," but have you ever tried to do as you please, even in your own back yard? It may eventually be illegal to cross state lines with "uncertified boilers."[4]

Model boilers, up to 1½" scale anyway, need not be "ASME;" this is a lot of bother for nothing. Some simple, easy-to-comply-with regulation can be adopted if we get off our duffs and get it done before someone undesirable does it for us. Otherwise, you may wake up some day to find that it is illegal to steam up your engine anywhere else but on your own property, and even then, either the long arm of the law could restrict you, or your homeowner's insurance policy could be null and void because of the presence of an "unsafe boiler." (By the way, the presence of a 2,000 p.s.i. oxygen cylinder within your home affects your insurance.)

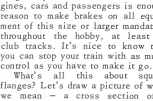
Brakes and flanges do not customarily come under political jurisdiction; that is, the public and legal boys couldn't care less about whether our model locomotives or rolling stock have brakes or round flanges. No law covers brakes on the two-wheel bicycle; all you have to do is demonstrate that you can stop. Of course, you're crazy to ride a brake-less bicycle, especially when you and the bike weigh over 75 pounds and you go out into heavy traffic. These items, brakes and flanges, are for the most part rules of various clubs. They are a problem mainly to the lone wolf who belongs to no club and questions the validity of brakes and round flanges. And, of course, you must include those members of clubs that have no brake and flange regulations. All is okay with these individuals as long as they are operating on home territory (their own track) – but when it comes time to visit a track *with* such regulations, you never heard such grumbling! Many refuse to attend Live Steam meets for just these reasons.

Luckily, most all ¾" and 1" scale "trains" have some sort of brake – usually in the form of a lever-operated pressure pad directly beneath the engineer on the riding

FLANGES

car. It seems to be the 1½" scale boys who haven't as yet been convinced that brakes on their equipment are necessary – mainly because it's too darn much work to install effective brakes. The usual stopping method on brake-less 1½" engines is to put 'er in reverse and drag your feet, in the hope that this and the drag (if any) from the cars behind you are enough to stop you before you hit the last car of the train in front of you! Rear end collisions in 1½" scale are not funny, and the frequency of such incidences is rising. The weight, speed and force of 1½" engines, cars and passengers is enough reason to make brakes on all equipment of this size or larger mandatory throughout the hobby, at least on club tracks. It's nice to know that you can stop your train with as much control as you have to make it go.

What's all this about square flanges? Let's draw a picture of what we mean – a cross section of a machined wheel used in any scale:



Many fellows who machine their own wheels come up with square flanges, either with flat or tapered heel. Why? Because it's a darned sight easier to machine square corners on a lathe than round corners. Rounding requires a little free-hand and time consuming skill with a hand tool and file. The old argument to justify the square flange is that it rides okay between the rails and "What the heck, only the heel really matters." It is these same fellows who blame derailments of their equipment on "crummy trackwork," never admitting, of course, that it is their square flanges that made the track crummy in the first place! What do square flanges do? First, they chew up aluminum rail something fierce, especially the outside rail on curves. Next, square flanges bounce through guard rails. Last, but not least, they mangle up switch points beyond repair. Is there a track without aluminum rail, guard rails and switches? If there is, it's an exception – and a pretty dull exception to boot. Anyone, be it individual or a club, with a decent track in any scale, should protect his trackwork by demanding that anything that rolls on their track must have rounded flanges. This can have serious effects on visitors to the various Live Steam meets, whether on club or private tracks. It isn't any more difficult to machine a wheel with contoured flanges than square ones. The prototype railroads have round flanges, and round flanges are standard on "HO" and "O" gauge model trains.(4) There is no reason why anyone should balk at this item, especially when it is a rule of the track. When you really look at it, properly contoured wheels look so much better than square flanged wheels, in *any* scale.

REFERENCES:

(1) – LIVE STEAM MAGAZINE, MAY, 1969, PP. 8–10

(2) – SUCH AS NMRA STANDARDS AND RECOMMENDED PRACTICES.

(3) – MODEL ENGINEER MAGAZINE, APRIL 1968, PP. 335 & 402

(4) – MODEL RAILROADER MAGAZINE, NOVEMBER, 1967, PP. 44–48

...from the cupola

Reaction to the editorial comments on boiler laws in LIVE STEAM Magazine for May 1969 was most gratifying. Many Live Steamers wrote to ask for more information on the Australian Miniature Boiler Safety Committee Code so we contacted the AMBSC to ask permission to reprint the Code in LIVE STEAM Magazine in order to acquaint American Live Steamers with the work being done by their group. The reply reads, in part, as follows:

We will be most happy for you to publish our Code in your excellent journal. We understand that there will be aspects of our Code that may not suit your own particular problems. However, I would mention that all stress calculations carried out for our own Code used the A.S.M.E. Code provision of permissable stress in Copper for a working pressure of 100 p.s.i., which is 3,800 lbs. I consider that it will be to your advantage to include this information in your preamble also.

You will also find enclosed a copy of the letter of approval from the controlling authority in the State of New South Wales. I must point out that, as in your country, each State has its own incident authority and that it will take some time to obtain a completely uniform approach by them all. At least they are not preventing clubs from operating.

The Code was adopted during our Annual Easter Convention in 1968 and a period of eighteen months was allowed to bring all boilers into line and to catch up with the physical job of inspection. This period expired on the 31st of October 1969 and most locomotives in operation in all States have been certified.

I trust that some progress is made in your country on this most important matter and if our work can contribute in any way we will be amply repaid.

With our best wishes for Safe Live Steaming.

R. V. WOOD, C. Eng.
Secretary
A.M.B.S.C.

On the following pages, the AMBSC Code is reprinted for the purpose of acquainting all Live Steamers with this document and in the hope that it will add impetus to the preparation of material in North America. Comments of some of the Live Steamers who responded are reproduced in the "mail stop" column on page 14.

– W. C. F. –

A.M.B.S.C. CODE

PART 1.

1968

Copyright by

AUSTRALIAN MINIATURE BOILER SAFETY COMMITTEE

20 Woodville Street, Hurstville. N.S.W.

The Australian Miniature Boiler

Safety Committee

Chairman: C. W. Gunning.

Secretary: R. V. Wood.

Committee members represented the following

Clubs from New South Wales.

Bankstown Steam Locomotive Society.
Blue Mountains Railway Society.
Illawarra Live Steamers.
Lake Macquarie Live Steam Locomotive Society.
Sydney Live Steam Locomotive Society.
Sydney Society of Model Engineers.

The Code was drafted and edited by

R. V. Wood C.Eng.

Stress calculations and tabulations were carried out by

S.L.N.Childs M.S.Mech.E.(Aust.)

Acknowledgment is made of the use of the Nomogram by

J.Greenly Steel

CODE FOR THE INSPECTION AND TESTING

OF MINIATURE BOILERS

This Code has been prepared in order to obtain maximum possible safety in the operation of miniature boilers not covered by existing Codes.

The purpose of the requirements set down is to provide a 'Common Basis' for Club Inspectors when examining and testing boilers for the purpose of issuing a 'Boiler Certificate' which will be acceptable by all the Clubs subscribing to the Code.

In reading the Code designers and builders should remember that the requirements are minimums only, heavier gauges and sizes may be used if so desired.

The Code is intended to cover boilers used in the construction of miniature locomotives up to and including 1" scale (0" gauge) when applied to full scale prototypes of 4' $8\frac{1}{2}$" gauge or to similar sizes miniatures when related to other scales or prototype gauges, also to boilers of similar size used in stationary, moving and other models.

It is based on design experience published in technical journals over the last 40 years, which has been confirmed by actual operating during the same period.

Constructors are urged to verify that drawings to which they intend to build do comply with the requirements of this Code before commencing actual construction. Further, it is desireable to refer such drawings to the Inspector of your club or if not a member of a club then the nearest club will be happy to make available the necessary technical advice.

In the event that a constructor wishes to build to conditions other than those provided for in this Code, such as working pressure, he should consult with the clubs inspector in detail before proceeding too far with the design.

This Code, Part 1 applies to 'All-copper' boilers of 'Firetube' type only. The A.M.B.S.C. hopes to extend the coverage of the Code to other materials of construction and design types at a later date.

Boiler Certificates issued under this Code by any of the Clubs listed below are acceptable by all the Clubs so listed.

CLUBS SUBSCRIBING TO THE A.M.B.S.C.
CODE AND THEIR IDENTIFICATION LETTERS.

Sydney Live Steam Locomotive Society, West Ryde, N.S.W.	N.A.
Sydney Society of Model Engineers, Ashfield, N.S.W.	N.B.
Illawarra Live Steamers, Wollongong, N.S.W.	N.C.
Lake Macquarie L.S.L.S., Newcastle, N.S.W.	N.D.
Blue Mountains Railway Society, Glenbrook, N.S.W.	N.C.
Bankstown Steam Locomotive Society, Bankstown, N.S.W.	N.F.
The Steam Locomotive Society of Victoria, Moorabin, Vic.	V.A.
Melbourne Society of M & E.E, Melbourne, Victoria.	V.B.
The Victorian Miniature L.S.L.S., Bendigo, Victoria.	V.C.
South Australian Society of M & E.E., Millswood, S.A.	S.A.
Whyalla Society of Model Engineers, Whyalla, S.A.	S.B.
The Queensland Society of Model Engineers, Brisbane, Q.	Q.A.

LIVE STEAM

ITEM 1 - MATERIAL SPECIFICATIONS

(a) General

Copper is the material to be used for the construction of all Barrels, Tubes, Boiler Plates, Foundation Rings, Firebole Rings, Girder Stays, Crown Stays, Rod and Tubular Stays unless otherwise noted under particular headings.

(b) Barrel

The tabulation Fig.1 sets out a range of gauges for varying barrel diameters and working pressures.

TABLE FOR BARREL, FRONT TUBEPLATE AND BACKHEAD

Minimum thickness in S.W.G. & Inches for:-

Barrel Outside Dia. in Inches	Barrel						Front T/plate & B/head					
	Pressures p.s.i.						Pressures p.s.i.					
	50	60	70	80	90	100	50	60	70	80	90	100
Up to 2½"	20 .036	20	20	20	20	20	18	18	18	18	18	18
Over 2½" to 3½"	20	20	20	19	18 .048	17 .056	18	18	18	18	17 .064	16
Over 3½" to 5"	20	19	18	17	16 .072	15	18	17	16	15	14 .080	12
Over 5" to 6½"	18	17	16	15	14 .092	13	16	15	14	13	12 .104	10
Over 6½" to 8"	17	16	14	13	12 .116	11	15	14	12	11	10 .128	8 .160

FIG.1

Solid drawn seamless copper tube is required (beware of butt-welded tube made for plumbing and agricultural use). If seamless tube is not available for tapered barrels, a riveted butt-strap joint silver brazed as in Fig.3 is satisfactory for all gauges, the butt-strap shall be the same gauge as the barrel.

The bronze brazed joint as in Fig.2 is not to be used for material thinner than 12 gauge and should only be undertaken by experienced welders.

The 'Tinsmiths' or interlocking tongue type joint if carefully made has proved satisfactory but has to be very well made to come up to the Butt-strap joint which is more easily constructed and is therefore recommended.

'Lap' or 'Joggled' joints are not acceptable for boiler barrels.

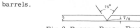


Fig.2 Bronze Braze Preparation

Fig.3 Silver Brazed Butt Strap Joint

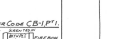
FIG. 4

STAYED FLAT SURFACES

TABLE BASED ON RULE 3.15.3 OF S.A.B. BOILER CODE CB-1P1.

MATERIAL:- COPPER PLATES AND STAYS

FORMULA for PRESSURE = $\frac{F\,k\,(t-x)^2}{A^2 + B^2}$



WHERE f = 3800 allowable stress in copper

k = 4.9 a factor for the types of staying shown above

t = thickness of plate in inches

A = distance between rows of stays in inches

B = pitch of stays in the rows in inches.

THE FOLLOWING IS ARRANGED TO SHOW THE MAXIMUM ALLOWABLE SQUARE PITCH OF STAYS AND ALSO THE MINIMUM SIZE OF SOLID SCREWED STAY

PLATE THICKNESS

S.W.G. INCH.

C - SQUARE PITCH E - DIA. OF SOLID STAY F - SCREWED STAY

MAXIMUM ALLOWABLE PRESSURE		20 .036	18 .048	16 .064	15 .072	14 .08	13 .092	12 .104	10 .128	8 .160	6 .192
50	C	7/8"	15/16"	1"	1 1/16"	1 1/16"	1 1/8"	1 1/8"	1 1/4"	1 3/8"	1 7/16"
	E	1/4	5/16	5/16	3/8	3/8	3/8	7/16	1/2	5/8	3/4
	F	B.B.A.	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	I.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT
60	C	13/16"	7/8"	15/16"	1"	1 1/16"	1 1/16"	1 1/8"	1 1/8"	1 1/4"	1 3/8"
	E	1/4	5/16	5/16	3/8	3/8	3/8	7/16	1/2	5/8	3/4
	F	B.B.A.	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	I.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT
70	C	7/8"	15/16"	1"	1 1/16"	1 1/16"	1 1/8"	1 1/8"	1 1/4"	1 3/8"	2 1/8"
	E	1/4	5/16	5/16	3/8	3/8	3/8	7/16	1/2	5/8	3/4
	F	B.B.A.	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	I.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT
80	C	11/16"	15/16"	1"	1 1/16"	1 1/8"	1 1/8"	1 1/8"	1 1/4"	1 1/2"	2"
	E	1/4	5/16	5/16	3/8	3/8	3/8	7/16	1/2	5/8	3/4
	F	B.B.A.	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	I.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT
90	C	7/8"	1"	1 1/16"	1 1/8"	1 1/8"	1 1/8"	1 1/4"	1 3/8"	1 1/2"	1 5/8"
	E	1/4	5/16	5/16	3/8	3/8	3/8	7/16	1/2	5/8	3/4
	F	B.B.A.	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	I.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT
100	C	15/16"	1"	1 1/16"	1 1/16"	1 1/8"	1 1/8"	1 1/4"	1 3/8"	1 1/2"	1 5/8"
	E	1/4	5/16	5/16	3/8	3/8	3/8	7/16	1/2	5/8	3/4
	F	B.B.A.	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	S.B.A. 3/4" NUTT	I.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT	O.B.A. 3/4" NUTT

(c) Tubes

Fire tubes shall not be less than the following gauges:

Up to $\frac{1}{2}$" Outside Diameter	24 gauge
7/16" " "	22 "
$\frac{1}{2}$" to $\frac{7}{8}$"(incl.)	20 "
Over $\frac{7}{8}$" to 1"	18 "

Water tubes for firebox and combustion spaces shall be not less than the following gauges:

Up to $\frac{1}{2}$" Outside Diameter	18 gauge
Over $\frac{1}{2}$" to $\frac{7}{8}$"	16 "
Over $\frac{7}{8}$" to 1"	14 "

(d) Plates

The Inner Firebox Wrapper, Tube and Backplates, also Throatplate and Outer Firebox Wrapper Plate when this is not part of the barrel must not be less than the gauges set out in Fig.1. In the event that the barrel is made of heavier gauge than called for in Fig.1 and consequently the Outer Firebox Wrapper then the stay pitching shall be as for the thinner plate (Inner Firebox Wrapper).
The Front Tubeplate and Backhead should be as set out in the tabulation Fig.1.

(e) Stays

Rod Stays - Rod stays may be threaded and nutted or threaded and headed or may be plain stays silver brazed. Stays are illustrated in Fig.4 and dimensions and pitch are set out in the tabulation.

Firebox Stays - For the staying of the firebox crown rod stays are the best when they can be used and should be of a size and pitch as in Fig.4
In some designs girder stays become necessary, typical construction is shown in Fig.5. The components should be loosely riveted so as to maintain location but as with all joints of this nature care is necessary to allow the correct gap for silver brazing and in this regard it should be noted that the clearance for a silver brazed joint is critical and for lap joints in copper a clearance of .005/.010 is satisfactory, the lesser clearance produces maximum strength the greater clearance should be used only for long laps. Independant of the means used, the unsupported area must not be greater than that allowed in the table for rod stays Fig.4. Girder stays should be constructed from copper sheet and generally according to the details of Fig.5. For small boilers up to $3\frac{1}{2}$" diameter Z type crown stays may be used and should be the same gauge as the barrel.

Longitudinal Stays - Longitudinal stays for Backhead and Front Tubeplate also Cross stays for Firebox should be as for gauge of plate see Fig.4. These stays should be fitted after brazing operations are completed they should be fitted with threaded nipples or nuts and may be sweated. An alternate material which may be silver brazed is Monel Metal (Note: Stainless Steel is not recommended in copper boilers).

(f) Combustion Chambers

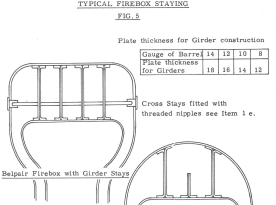
The 'D' shaped cross section of the average combustion chamber has but little greater strength than a flat plate of the same gauge. The cross water tubes support the

TYPICAL FIREBOX STAYING

FIG. 5

Plate thickness for Girder construction

Gauge of Barrel	14	12	10	8
Plate thickness for Girders	18	16	14	12


Cross Stays fitted with threaded nipples see Item 1 e.
Belpair Firebox with Girder Stays
Round Top Firebox - Larger sizes.
All joints Silver Brazed
Single flange Girder Stays same gauge as barrel
Rod Stays as in Fig.4
Belpair Firebox with Rod Stays
X
X = Gauge of Barrel x 10
Round Top Firebox - Smaller sizes.

Unsupported areas of all flat surfaces not to exceed square pitch as in Fig.4

LIVE STEAM

top and bottom but the unsupported shoulders of the 'D' and and the continuation running down to the water tubes is subject to collapse and this area should be kept to a minimum. It is extremely difficult to stay this area to the boiler shell, continuously threaded stays sweated with soft solder being about the only means of so doing. Most existing designs have proved satisfactory and if failure occurs this usually takes place during the first hydrostatic test. In the remote case of failure when steaming there in no real danger to the operator or to bye-standers.

(g) Mountings
All brazed in mountings and bushings for fittings, safety valves, regulators, domes etc. are to be of copper or copper base alloy.
Steam and Water fittings shall not be screwed directly into the copper plates of the boiler, mounting bushes must always be provided.

ITEM 2 - DESIGN
Whilst this will of necessity vary according to requirements the general principles shown in Fig. 6 are considered to be good practice.

ITEM 3 - CONSTRUCTION
Notwithstanding all that may be specified in materials and design, it is imperitive that good practice be used in all stages of construction. Adjoining faces should be reasonably flat and have uniform clearance (fit) according to the brazing procedure to be adopted (clearance for most forms of lap joints should be .005"). Butt joints for Bronze brazing must be properly formed as in Fig. 2. Butt-strap and riveted work requires to be neatly formed and clearly assembled so that subsequent silver brazing will thoroughly penetrate the whole of the surface. This also applies to the fitting of flanged plates to wrappers and barrels. When plates are flanged a minimum radius of T x 1 shall be maintained on the inside of the flange. Foundation rings require careful fitting around flanges and other forms encountered in between firebox and outer wrapper. Above all brazing and silver brazing practice should conform to the specification of the material being used.

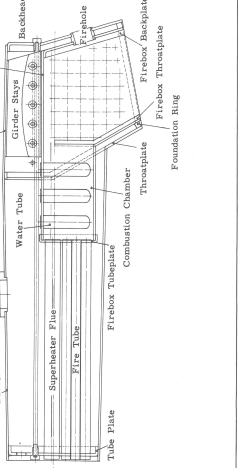
ITEM 4 - BRAZING MATERIALS
The following brazing and silver brazing materials are recommended:

Bronze Brazing	Tobin Bronze
Silver Brazing	Dark Blue tip No. 245 for all normal applications. No. 235 and No. 333 may be used if and when a higher brazing temperature is an advantage. In some cases a flux free material such as No. 115 may be of advantage.

Note: C.I.G. materials are mentioned but equivalent specifications are acceptable.

The Bronze brazing of the spear ends of superheater elements is recommended.

TYPICAL BOILER CONSTRUCTION



ITEM 5 - WORKING PRESSURE

The maximum working pressure provided for in this Code is 100 p.s.i.

Pressures higher than the foregoing will require to be covered by special provisions.

ITEM 6 - FITTINGS

(a) Flange Mountings

All fittings flange mounted to the boiler should be provided with securing studs of Tobin Bronze, Drawn Bronze or Monel Metal with Steel or Bronze nuts. Bolts of similar metals may be used but Studs are to be preferred. Flanges and securing studs should be as Fig.6

P, C, D,	1"	1¼"	1½"	1¾"	2"
No. of Studs	8	8	8	10	10
Size (B.A.)	7	5	4	4	3

D = O/Dia. of Stud

FLANGE SIZES FIG. 6

(b) Safety Valves

All boilers shall be fitted with a safety valve and when practicable Two safety valves shall be fitted. Minimum area of valves is to comply with the Nomogram Fig.7

SAFETY VALVE ORIFICES

(E. A. Shell)

GAUGE PRESSURE
LB per sq. in
HEATING SURFACE
(sq.ft.)
DIAMETER OF VALVE ORIFICE
(mm)
SINGLE
DOUBLE
STEAMOUT 1000
To find the diameter of orifice, place a straight edge or rule on the chart so that it touches the known boiler steam pressure and heating surface, and read off directly the size of orifice required. For example: Boiler pressure 70 lb. sq. in. Heating surface 1000 square feet. Join 70, 1000. Therefore, with the straight edge placed along the line A and B, the size of orifice required is 2.75 in. or 0.5 in. diameter. For 1000 sq.ft. heating surface, the orifice is 0.75 in. for each.
(Exemption certified by J. Grant, Esq.)

Fig. 7

Item 6 (b) continued

Safety valves are to be provided with means of locking the pressure adjustment.

Steam shall enter the body of the valve by a straight passage and not by means of any cross passage.

It is desireable that safety valve springs be of non-corrodable material.

Safety valves are to be so constructed that it is impossible to lock the valve down solid by means of the pressure adjustment.

(c) Pressure Gauge and Syphon

All boilers must be fitted with a pressure gauge which has been tested against a master gauge of known accuracy. Pressure gauges are to be connected to the boiler by means of a syphon.

(d) Water Gauge

All boilers must be fitted with a water gauge, the bottom nut of which should be above the crown of the firebox by not less than 10% of the total distance from the crown to the outer wrapper. The gauge glass should be as long as possible. All passages in water gauges are to be not less than $\frac{1}{4}$" diameter. All water gauges are to be fitted with a blow down cock. Cleaning plugs are most desirable.

(e) Blowdown Valve

When practicable the fitting of a Blowdown valve is to be desired.

(f) Washout Plugs

A bush or bushes shall be fitted for washout plugs and located as low as possible on the external plates of the firebox.

(g) Fusible Plugs

Fusible Plugs are a desirable safety feature if properly made and fitted and although not a mandatory requirement can be used to advantage in the larger size boiler. If fitted they should be located in the crown of the firebox so that when they blow the fire is extinguished. Plugs with low melting point tones alone may give trouble due to possible deterioration of the fusible metal but if fitted with a copper plug as illustrated in Fig. 8 can be quite satisfactory.

Fig. 8.

ITEM 7 - INSPECTION

Inspection and Testing shall be carried out by the duly appointed Boiler Inspector of the Club issuing the Boiler Certificate, and in the presence of a witness who shall be a member of the Club and other than the designer or builder of the boiler being Tested.

PROCEDURE

(a) Each issuing club shall maintain a Boiler Record in the form of Fig. 10.

(b) Each individual record shall be numbered in numerical sequence. Each boiler shall be given an identification which will indicate

Item 7 (b) continued,

the State, Club, Date and Numerical number as follows:

(State) N (Club) A (Date) 68 (Serial) 1
= NA. 68. 1

This number shall be stamped on the boiler when finally passed by the Inspector. The underside of the foundation ring is a suitable place. It is pointed out that once the boiler is identified there will be only infrequent need to check this number.

(c) Inspection during construction shall be carried out at the discretion of the Inspector.

(i) Prepared plates and tubes including all flanged work.

(ii) Firebox and Tube assembly after brazing.

(iii) Barrel and Wrapper assembly after brazing.

(iv) Finished Boiler (construction only).

(d) TESTING PROCEDURE

(i) Hydrostatic Test to Working Pressure (P) x 2 maintained for not less than 20 minutes and including a check for distortion of flat surfaces, it is recognised that some slight movement will take place.

(ii) Inspection under steam pressure during which safety valves will be set and also checked to ensure that they will prevent a pressure rise of more than 10% of P under maximum firing conditions.

(iii) Pressure gauge to be checked against a master gauge of established accuracy.

(iv) Water gauge to be checked for correct functioning.

(v) A Boiler Certificate will be issued for a period of three years and shall be signed by the Clubs' Inspector and the Witness see Fig. 9. After the expiry of this period a re-test shall be carried out, to the satisfaction of the Inspector consisting of a Hydrostatic test to P x 1½ and also a check of all gauges, a new certificate will be issued.

(vi) In the event of any major repair or rebuild, a Hydrostatic test of P x 1½ shall be carried out.

(vii) A boiler which has been out of service for a period in excess of six months shall be submitted for a safety check to ensure that the boiler fittings are still functioning correctly.

ITEM 8 - EXCEPTIONS

Boilers in course of construction or already constructed prior to the date of adoption of this Code shall receive special consideration in regard to the requirements of this Code, it will be the responsibility of the Boiler Inspector to ascertain that the design and construction is of sound quality having in mind the standards layed down.

Existing boilers as above shall be given a first Hydrostatic test to P x 1½ prior to the issue of a Boiler Certificate which shall carry notation that the boiler certified predates this Code.

At the Inspectors discretion he may require the removal of the boiler from the frames if fitted to a locomotive and also the removal of the cleading or any other detail to make possible proper testing conditions.

Item 8 continued

Existing boilers shall be tested within eighteen months of the date of adoption of this Code or when its existing certificate if any, expires, whichever period is the least.

In the case of a rejection by a Boiler Inspector, the Owner shall have the right of appeal to the A.M.B.S.C.

This Code shall not apply to boilers having a diameter of 2" or less and a total capacity of less than 30 cubic inches.

AUSTRALIAN MINIATURE BOILER
SAFETY COMMITTEE

BOILER CERTIFICATE

Issued by_____

Issued to_____

Boiler Identification_____

_____

Approved working pressure_____ P.S.I.

Date of Issue_____

Date of Expiry_____

Signed_____ Boiler Inspector

Signed_____ Witness

FIGURE 9

The Australian Miniature Boiler
Safety Committee

BOILER RECORD

Issued by _____

GENERAL DETAILS

Builder _____

_____

Owner _____

_____

Club _____

Identification _____

Working Pressure (P) _____

General Description (Indicate new or existing boiler) _____

_____

_____

Application _____

_____

_____

Design Details (Drg.No. and details to be set out below)

_____

_____

_____

_____

_____

CONSTRUCTION CHECK

Flatwork Date of approval ____ / / ____
Signed _____
Signed _____

Firebox & Tube Assy. (Brazed up) Date of approval ____ / / ____
Signed _____
Signed _____

Boiler Shell & Wrapper Assembly Date of approval ____ / / ____
Signed _____
Signed _____

Finished Boiler (Construction only) Date of approval ____ / / ____
Signed _____
Signed _____

TEST RECORD

HYDROSTATIC TEST P x 2 _____ P.S.I.
Duration _____ Min.
Date _____
Notes _____

_____

_____

_____

Signed _____ Inspector
Signed _____ Witness

STEAM TEST (Under normal fireing conditions)
Duration, High to Low water level _____ Min.
Pressure P + 10% Accumulation _____ P.S.I. Max.
Safety Valves _____
Water Gauge _____
Pressure Gauge _____

Date ____ / / ____
Signed _____ Inspector
Signed _____ Witness

CERTIFICATE ISSUED From ____ / / ____ To ____ / / ____
Signed _____ Inspector
Signed _____ Witness

CERTIFICATE REISSUED FROM ____ / / ____ To ____ / / ____
Notes _____
Signed _____ Inspector
Signed _____ Witness

CERTIFICATE REISSUED From ____ / / ____ To ____ / / ____
Notes _____
Signed _____ Inspector
Signed _____ Witness

CERTIFICATE REISSUED From ____ / / ____ To ____ / / ____
Notes _____
Signed _____ Inspector
Signed _____ Witness

North Eastern Ohio Live Steamers Organized

PHOTOS BY RICHARD DUTE

On September 13th, 1969, an organizational meet was held at the home of Clinton Ensworth of Medina, Ohio. Present were 22 Live Steamers from Northern Ohio and two from Michigan.

Five ¾" scale engines from chassis to completed engine, one 1½" chassis and one completed 1½" engine were on display. A total of nine ¾" scale engines and seven 1½" scale engines were built or being built by those in attendance. Many engines of various scales are being planned for the future.

After a picnic lunch, Clint Ensworth's 1½" American developed a valve gear problem which was quickly solved by Norm Young of Akron and Robert Ebert of Wooster. After an hour or so of work, away it went, chugging down the track!

About three o'clock, Richard Dute called the meeting to order and, after introductions, a discussion was held on the organization of the club. Richard Dute was appointed acting chairman of the group.

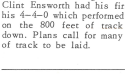
After the meeting was adjourned, Clint Ensworth had his first ride on his 4–4–0 which performed very well on the 800 feet of track presently down. Plans call for many more feet of track to be laid.

At a second meeting held on October 19th at Fred Birkhimer's home in Salem, Ohio, the group adopted the name of *North Eastern Ohio Live Steamers* as its title. Richard Dute was named President and William O'Neill as the club's Secretary. Ten new faces appeared at the second meeting, some from Pennsylvania.

There will apparently be no "feet-dragging" in this group. On November 16th, at its third meeting, arrangements were approved which will pave the way for leasing of land on which to build complete club facilities!

If you want to be a part of this active group, contact William F. O'Neill at 251 Melbourne Avenue, Akron, Ohio 44313 for more information.

At the Organizational Meet, Paul Haar (l) of Fairview Park and Ted Bonn (r) of Parma, Ohio (top) look over Paul's 0–8–0 switcher while Clint Ensworth looks on as Norm Young of Akron adjusts the valve gear on Clint's engine (center). There's good reason for the smile on Clint's face (lower) as he takes his first run on his just-completed Little Engines 4–4–0!



Scheduled Meets

January

1 **FLORIDA NEW YEARS' MEET**
3½" – 4¾" gauges
Enos W. Yoder
1527 Ingram Avenue
Sarasota, Florida 33580

Regular Run Days

GOLDEN GATE LIVE STEAMERS
Every Sunday, weather permitting
2½" – 3½" – 4¾" – 7¼"
Gordon French, Secretary
614 18th Avenue
Menlo Park, Calif. 94025
Phone 415 – 325-4209

RIVERSIDE LIVE STEAMERS
4th Saturday-Sunday each month
Hunter Park - Iowa & Columbia Ave.
Riverside, California
Francis H. Smith, Secretary
5536 Dewey Avenue
Riverside, California 92504
Phone 688-9533 or 683-9628

LOS ANGELES LIVE STEAMERS
1st Sunday each month
3½" – 4¾" – 7¼"
Joel Corbin, Secretary
12723 Kittridge Street
North Hollywood, Calif. 91606

MONTREAL LIVE STEAMERS
1st Sunday of each month
3½" – 4¾" – 7¼" gauges
S. H. Galloway, Secretary
53 Brentwood Road
Beaurepaire, Quebec, Canada

PIONEER VALLEY LIVE STEAMERS
2nd Sunday each month
3½" – 4¾" – 7¼"
Brenton W. Bannfather, Secretary
3 Fleetwood Drive
Sandy Hook, Conn. 06482

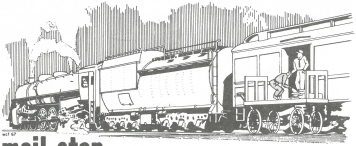
RAILROADERS CLUB OF SAN ANTONIO
3rd Sunday each month,
weather permitting
7¼" gauge
Ces Beck
2626 McCullough Avenue
San Antonio, Texas 78212

JAMUL VALLEY RAILROAD
3rd Sunday each month
7¼" gauge
Harry F. Haas
Route 1, Box 47 A
Jamul, California 92035

SOUTHERN CALIFORNIA LIVE STEAM CLUB
3rd Sunday each month
3½" – 4¾" – 7¼"
K. G. Kepner, Secretary
2764 Maple
Rialto, California 92376

WABASH, FRISCO & PACIFIC
Every Sunday
12" gauge
Grand and First Streets
0.4 miles south of Post Office
Glencoe, Missouri

WAUSHAKUM LIVE STEAMERS
2nd Sunday each month
8:30 a.m. to 4:00 p.m.
3½" gauge, on Route 126
Ashland, Mass.
Wendell C. Bishop, Secretary
52 Pond Street
Natick, Mass. 01760



mail stop

DONE!

I wonder if it would be possible for you to obtain a copy of the AMBSC Code and publish it in LIVE STEAM Magazine. This might pave the way for the adoption of a "model" Model Boiler Code at the U. S. convention next year.

DONALD W. PATRICK, President
Omaha Area Live Steamers
1535 SOUTH 55TH STREET
OMAHA, NEBRASKA 68106

BOILER COMMENTS

I am hopeful that the AMBSC Code will help me with the design of my boiler.

As for volunteering for the suggested project, I will be glad to do what I can, but I feel that many others have had so much more experience than I that I would probably be learning more from the committee work than I would contribute.

F. C. "ROCKY" ROCKSTROH
1305 MOUND STREET
ALAMEDA, CALIFORNIA 94501

Would it not be to our advantage to work with ASME to find out how miniature locomotives can be produced in home workshops by amateur engineers and machinists (and maybe welders) so as to comply with ASME specifications. After all, darned few of us are professional mechanical engineers – why should we not seek and heed the advice and experience of those who are experienced?

IRA D. S. KELLY, C. Eng.
5300 WEST 58TH
MISSION, KANSAS 66205

I agree that a set of construction standards (or our own Code, if you will) would be a good solution and certainly along with it a maximum boiler pressure, say 100 psi, to apply to all scales and all boilers. Most engines, if tuned right and decent workmanship, will do their all very nicely at 100 lbs. and many will do nearly as well at 60 psig. There should be standards, of course, for both steel and copper boilers.

WILLIAM I. TREADWAY
352 BREWSTER ROAD
BRISTOL, CONN. 06010

I would say that if the calculated safety factors based on the yield strength and ultimate strength of the material could be shown to the authorities, that they would have to consider the design as acceptable. Also a reasonable boiler test pressure could be specified which would not cause permanent deformation. Probably a minimum test pressure of twice the steam pressure would be realistic.

CARL W. LARSON, M.E., P.E.
24 FOREST AVENUE
CALDWELL, N. J. 07006

Copies of the AMBSC Code have been available for members to study at club meetings and a copy is in the club library.

Our life would be a lot easier if we could get this, or its equivalent, adopted as part of the Wisconsin boiler code.

JACK D. McKENTY, M.D.
Secretary
MILWAUKEE LIGHT ENGINEERING SOCIETY

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962 Greenland Road
Portsmouth, N. H., 03801

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Philadelphia, Pa. 19111
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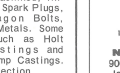

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